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LOBLOLLY PINE RELEASE STUDY

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LOBLOLLY PINE RELEASE
Report #20
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ABSTRACT

This study included three treatments in which basal spraying, using two different concentrations of 2,4,5-T, was compared to no release. Basal spraying was done in the winter, following the first growing season in the field. Hardwood competition varied, and on the average was moderate. At age 17, 1:40 plots averaged 32 percent more basal area and 65 percent more volume in standard cords than check plots, and 1:20 plots averaged 17 percent more basal area and 28 percent more volume in standard cords than check plots. Cordwood yields were related to both hardwood basal area measured at age 17 (r^2 = .894) and a free-to-grow index estimated at age 2 (r^2 = .680).

INTRODUCTION

This is the twentieth in a series of Occasional Reports concerning release of loblolly pine seedlings from hardwood competition. This study was installed on the privately-owned Atkins tract in Louisa County, in the central Piedmont of Virginia. The previous stand was mixed hardwood, primarily oak. The tract was drum-chopped and prescribed-burned in the summer of 1970, and planted in March of 1971. Basal spraying was done on February 1 and 2, 1972, after the first growing season in the field. Three swaths, each two chains wide and ten chains long, were established (Figure 1). One swath was basal sprayed using a 1:40 dilution of 2,4,5-T in fuel oil and another swath was basal sprayed using a 1:20 dilution, leaving the third swath unsprayed as a control. The 2,4,5-T contained four pounds of active ingredient per gallon.

GROWTH PLOT INSTALLATION

Plots were installed at age 2, during the winter following basal spraying. Nine 1/10-acre plots were installed, three in each swath. Plots were located in the front half of each swath, to avoid steeper slopes associated with drainages occurring in the back half of the swaths (Figure 1). Hardwood competition was moderate and varied across the study area, with the 1:40 swath having the least hardwood competition and the 1:20 swath the most. Volunteer Virginia pine and shortleaf pine seedlings were pulled up when the plots were installed.

Measurements were made at age 2, when the plots were established, and at ages 9, 13, and 17. At age 2, all loblolly pine seedlings were measured for height to the nearest foot, and classified as to free-to-grow status using a four part classification system.1/ At later measurements, diameter at breast

1/ See Occasional Report No. 78 (Release Report No. 11) for a description and discussion of this classification system.

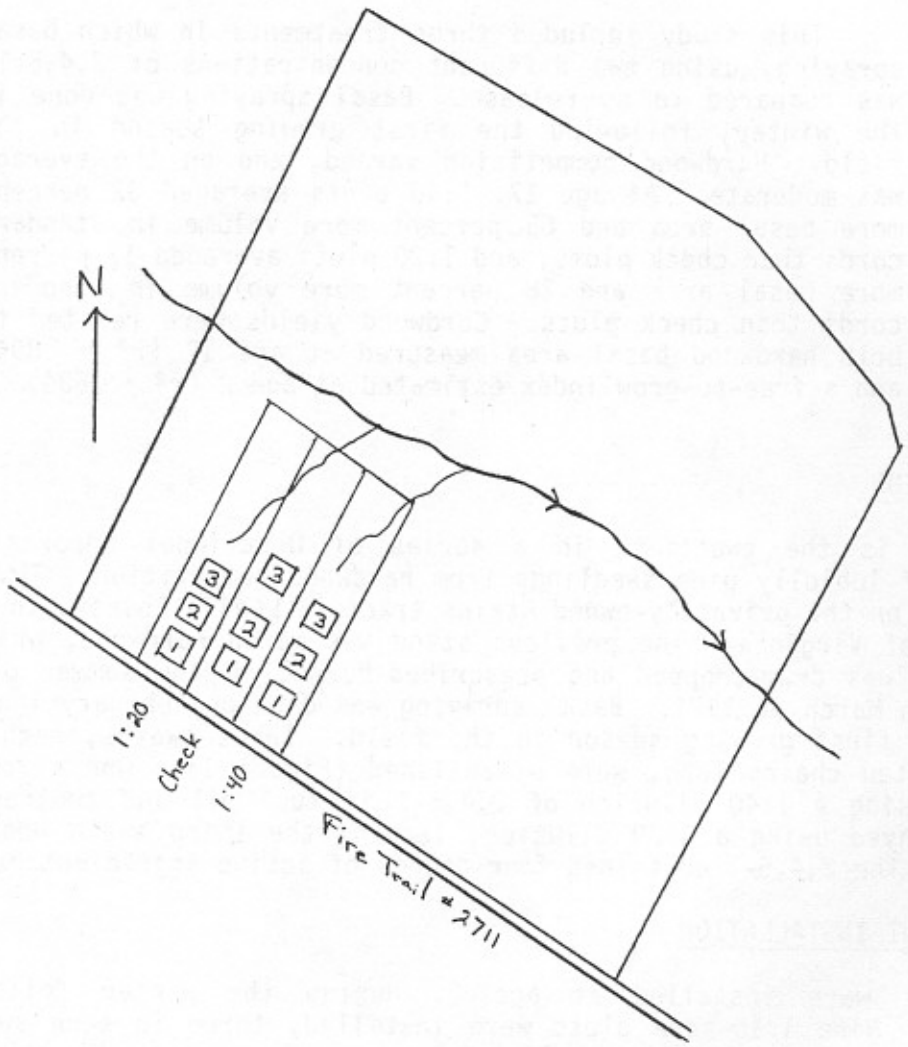

Figure 1. Layout of growth plots.

height of each loblolly pine was measured to the nearest inch, and a sample of trees in each diameter class was measured for total height to the nearest foot, noting which trees were dominant and codominant. For the final measurement at age 17, all hardwoods over .5 inch DBH were tallied by species, 1-inch diameter class, and crown class. Total height to the nearest foot was measured on 80 percent of the intermediate hardwoods and all of the codominant and dominant hardwoods.

RESULTS AND DISCUSSION

A summary of loblolly pine data for the four measurements is presented in Table 1. At age 17, 1:40 plots averaged 10.3 standard cords per acre and 1:20 plots averaged 4.5 standard cords per acre more than check plots.2/ Differences due to release increased with time (Table 2). Table 3 presents stand tables for loblolly pine at age 17.

A summary of average hardwood data at the final measurement at age 17 is presented in Tables 4 and 5, and individual plot data is presented in Table 6. Comparing numbers of hardwoods, 1:40 plots averaged 21 percent fewer hardwoods than check plots, but 1:20 plots averaged about as many hardwoods as check plots. There were more of the larger hardwoods on the check plots, however, which resulted in greater hardwood basal area. On the average, check plots had about 2.5 times as much hardwood basal area as the 1:40 plots, and 1.4 times as much basal area as the 1:20 plots.

There were a total of 11 codominant and four dominant hardwoods on the three check plots (50 per acre), none on the three 1:40 plots, and five codominant hardwoods on the three 1:20 plots (17 per acre). These dominant and codominant hardwoods (scarlet and black oak, yellow-poplar, bigtooth aspen, and black cherry) ranged in height from 35 to 51 feet and averaged 41 feet. Some of these hardwoods will continue to maintain a place in the canopy. Check plot 2 will probably end up with about one-quarter hardwood in the canopy, and check plot 1 will probably also have some hardwood in the canopy.

Cordwood yields of loblolly pine at age 17 were related to the amount of hardwood present. Figure 2 shows pine cordwood yields related to hardwood basal area at age 17, for the nine plots. A simple linear regression fitted to these data accounted for 89 percent of the variation in cordwood yields.3/

2/ Standard cords at age 17 were subjected to an analysis of variance for randomized blocks (caution should be used in interpreting the results of this analysis, because treatment plots could not be truly randomized). The probability of a larger overall F for treatments was .045. Duncan's New Multiple Range Test was used to test for differences between treatment means. Average yields on 1:40 plots were significantly greater than on check plots (.05 level), but average yields on 1:20 plots were not.

3/ Estimated standard cords = 31.44 - .5029 (hardwood basal area), r^2 = .894, probability of a larger F = .0001.

Table 1. A summary of loblolly data at ages 2, 9, 13 and 17: number of trees per acre, average DBH, basal area per acre, standard cords per acre, and average height of dominant and codominant trees.*

	Check Plots						1:40 Plots						1:20 Plots					
Age	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.
2	1	830	-	-	-	3.0	1	870	-	-	-	3.2	1	870	-	-	-	3.0
	2	830	-	-	-	3.1	2	790	-	-	-	2.7	2	810	-	-	-	3.0
	3	1,020	-	-	-	3.5	3	800	-	-	-	3.2	3	830	-	-	-	3.1
Means		893	-	-	-	3.2		820	-	-	-	3.0		837	-	-	-	3.0
9	1	810	3.26	53.2	-	25.3	1	870	4.03	80.4	-	27.4	1	860	3.62	65.9	-	25.7
	2	780	2.91	40.4	-	23.9	2	780	4.13	76.4	-	27.3	2	810	3.72	64.7	-	25.4
	3	1,020	3.61	77.3	-	26.6	3	780	4.09	74.3	-	26.6	3	830	3.69	67.0	-	26.1
Means		870	3.26	57.0	-	25.3		810	4.08	77.0	-	27.1		833	3.68	65.9	-	25.7
13	1	760	4.37	85.5	7.0	35.5	1	860	4.98	122.2	14.2	37.4	1	830	4.57	102.0	9.7	36.8
	2	750	3.83	66.7	4.5	34.7	2	780	5.26	123.2	15.7	37.9	2	780	4.73	100.2	9.7	36.3
	3	1,000	4.43	115.0	10.0	36.2	3	770	4.99	109.8	12.8	37.0	3	790	4.57	98.6	9.2	36.0
Means		837	4.21	89.1	7.2	35.5		803	5.08	118.4	14.2	37.4		800	4.62	100.3	9.5	36.4
17	1	700	5.07	105.9	14.9	43.2	1	840	5.58	151.0	25.0	44.9	1	800	5.32	134.2	21.2	44.1
	2	680	4.69	89.5	11.7	43.4	2	740	6.04	155.2	28.3	47.7	2	770	5.39	128.4	19.0	44.0
	3	990	4.92	143.1	20.8	44.3	3	770	5.58	140.0	24.9	46.7	3	760	5.49	134.3	20.7	43.4
Means		790	4.89	112.8	15.8	43.6		783	5.73	148.7	26.1	46.4		777	5.40	132.3	20.3	43.8

* Except at age 2, where heights presented are for all trees.

Table 2. Average differences between check and released plots at each measurement, for basal area and standard cords per acre.

	1:40 minus Check		1:20 minus Check	
Age	Basal Area	Std. Cds.	Basal Area	Std. Cds.
9	20.0	-	8.9	-
13	29.3	7.0	11.2	2.3
17	35.9	10.3	19.5	4.5

Table 3. Average number of loblolly pine per acre by diameter class at age 17.

DBH	Check Plots	1:40 Plots	1:20 Plots
1	7	0	3
2	30	13	17
3	110	47	53
4	157	90	130
5	216	153	204
6	157	237	184
7	83	187	133
8	30	43	53
9	0	13	0
Totals	790	783	777

Table 4. Average numbers of hardwoods per acre by species and diameter class at age 17.

Check Plots

Species	DBH 1	2	3	4	5	6	7	Totals
Red oak	157	53	47	30	17			304
White oak	230	93	27		10	3		363
Yellow-poplar	133	37	13	10		7	3	203
Black cherry	60	7	3					70
Red maple	170	23	3					196
Blackgum	377							377
Hickory	130		3					133
Bigtooth aspen	43	10	10	7	3	3		76
Sassafras	157							157
Dogwood	120							120
Holly	3							3
Totals	1,580	223	106	47	30	13	3	2,002

1:40 Plots

Species	DBH 1	2	3	4	5	Totals
Red oak	230	30	4			264
White oak	160	20	7		3	190
Yellow-poplar	123	30	3	3		159
Black cherry	13	10	3			26
Red maple	284	27				311
Blackgum	193					193
Hickory	160					160
Bigtooth aspen	10					10
Sassafras	200					200
Dogwood	70	3				73
Totals	1,443	120	17	3	3	1,586

1:20 Plots

Species	DBH 1	2	3	4	5	6	Totals
Red oak	110	27	10				147
White oak	243	60					303
Yellow-poplar	280	109	24	10	4		427
Black cherry	13	17	13	10	3	3	59
Red maple	93	37	3				133
Blackgum	431	3					434
Hickory	147	10					157
Bigtooth aspen	37				3		40
Sassafras	274	7					281
Dogwood	80	3					83
Sweetgum	3						3
Totals	1,711	273	50	20	10	3	2,067

Table 5. Average numbers of hardwoods per acre by diameter class and crown class, and basal area by crown class, at age 17.

Check Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,580				1,580
2	223				223
3	43	63			106
4		30	17		47
5		10	17	3	30
6		3	3	7	13
7				3	3
Totals	1,846	106	37	13	2,002
B.A.	15.6	7.7	4.4	2.6	30.2

1:40 Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,443				1,443
2	120				120
3	17				17
4		3			3
5	3				3
Totals	1,583	3			1,586
B.A.	11.7	.3			12.0

1:20 Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,711				1,711
2	273				273
3	33	17			50
4	6	7	7		20
5		3	7		10
6			3		3
Totals	2,023	27	17		2,067
B.A.	17.4	1.9	2.2		21.4

Table 6. Numbers of hardwoods by diameter class and crown class, and basal area by crown class, on each 1/10-acre plot.

Check - #1

DBH	O	I	CD	D	Totals
1	127				127
2	19				19
3	6	7			13
4		1	3		4
5		2	2		4
6				1	1
7					
Totals	152	10	5	1	168
B.A.	1.40	.70	.54	.20	2.84

Check - #2

DBH	O	I	CD	D	Totals
1	164				164
2	27				27
3	2	12			14
4		8	1		9
5		1	3	1	5
6				1	1
7				1	1
Totals	193	21	4	3	221
B.A.	1.58	1.42	.50	.60	4.10

Check - #3

DBH	O	I	CD	D	Totals
1	183				183
2	21				21
3	5				5
4			1		1
5					
6		1	1		2
Totals	209	1	2		212
B.A.	1.70	.20	.28		2.18

1:40 - #1

DBH	O	I	CD	D	Totals
1	140				140
2	12				12
3	2				2
Totals	154				154
B.A.	1.12				1.12

1:40 - #2

DBH	O	I	CD	D	Totals
1	133				133
2	12				12
3	3				3
Totals	148				148
B.A.	1.13				1.13

1:40 - #3

DBH	O	I	CD	D	Totals
1	160				160
2	12				12
3	-				-
4	-	1			1
5	1				1
Totals	173	1			174
B.A.	1.27	.09			1.36

1:20 - #1

DBH	O	I	CD	D	Totals
1	163				163
2	28				28
3	2				2
4					
5					
Totals	193				193
B.A.	1.60				1.60

1:20 - #2

DBH	O	I	CD	D	Totals
1	160				160
2	32				32
3	6	3			9
4		1	1		2
			1		1
Totals	198	4	2		204
B.A.	1.86	.24	.22		2.32

1:20 - #3

DBH	O	I	CD	D	Totals
1	190				190
2	22				22
3	2	2			4
4	2	1	1		4
5		1	1		2
6			1		1
Totals	216	4	3		223
B.A.	1.80	.32	.42		2.53

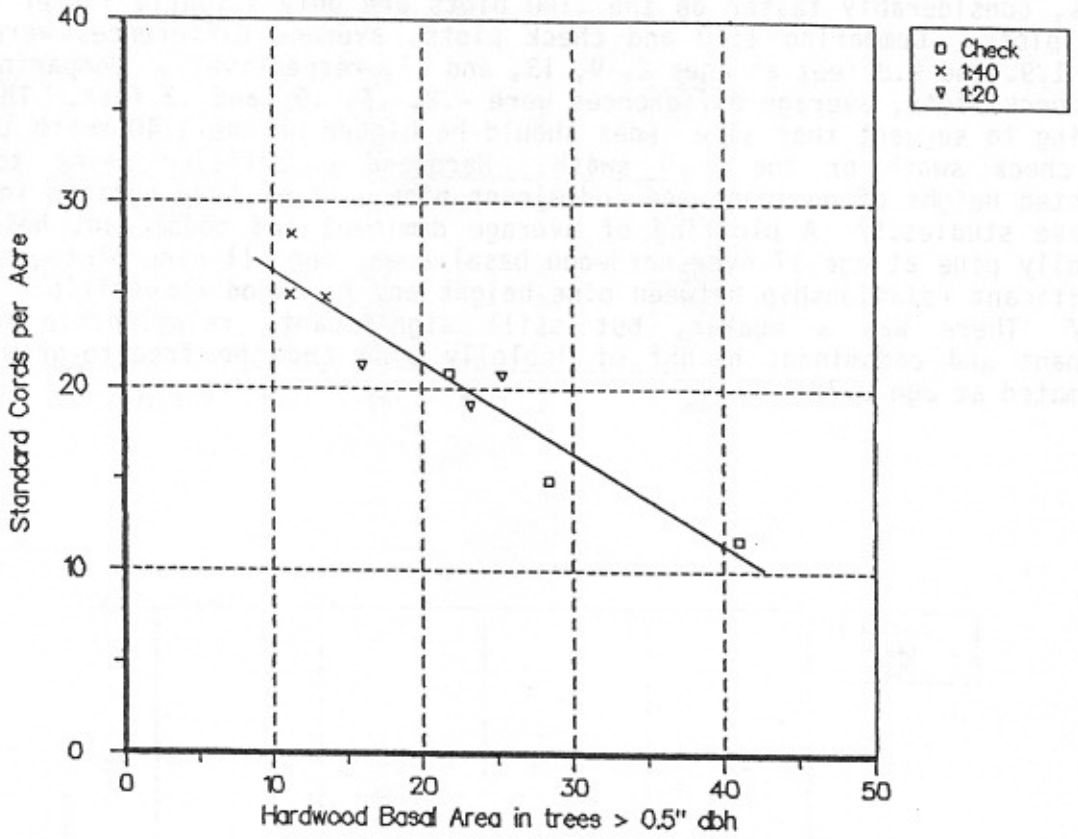

Figure 2. Pine cordwood yields at age 17 related to hardwood basal area.

Cordwood yields also correlated well with the average free-to-grow index for each plot at age 2. Table 7 shows the percent of trees in each free-to-grow class for each plot, at age 2. In Figure 3, pine cordwood yields at age 17 are plotted over average free-to-grow index at age 2 for each plot. A simple linear regression fitted to these data accounted for 68 percent of the variation in cordwood yields.4/

Dominant and codominant loblolly pines have grown faster on the released plots, considerably faster on the 1:40 plots and only slightly faster on the 1:20 plots. Comparing 1:40 and check plots, average differences were -.2, 1.8, 1.9, and 2.8 feet at ages 2, 9, 13, and 17, respectively. Comparing 1:20 and check plots, average differences were -.2, .4, .9, and .2 feet. There is nothing to suggest that site index should be higher on the 1:40 swath than on the check swath or the 1:20 swath. Hardwood competition seems to have affected height of dominant and codominant pines, as we have noticed in other release studies.5/ A plotting of average dominant and codominant height of loblolly pine at age 17 over hardwood basal area, for all nine plots, shows a significant relationship between pine height and hardwood competition (Figure 4).6/ There was a weaker, but still significant, relationship between dominant and codominant height of loblolly pine and the free-to-grow index estimated at age 2.7/

4/ Estimated standard cords = 40.94 - 12.5483 (free-to-grow index at age 2), r^2 = .680, probability of a larger F = .0063.

5/ See Occasional Report No. 75 (Release Report No. 8) for a discussion of this relationship and its probable cause.

6/ Estimated pine height = 47.12 - .1166 (hardwood basal area), r^2 = .518, probability of a larger F = .029.

7/ Estimated pine height = 49.81 - 3.2126 (free-to-grow index at age 2), r^2 = .480, probability of a larger F = .039.

Table 7. Percent of trees by free-to-grow class for each plot, at age 2.

		Free-to-grow Status				
	Plot	1	2	3	4	Means
Check	1	30	56	10	4	1.87
	2	6	73	15	6	2.21
	3	25	70	2	3	1.83
	Means	20	66	9	4	1.97
1:40	1	72	28			1.28
	2	68	31		1	1.35
	3	78	22			1.22
	Means	73	27	-	-	1.28
1:20	1	50	44	2	4	1.60
	2	71	26		3	1.34
	3	28	68	2	2	1.80
	Means	50	46	1	3	1.58

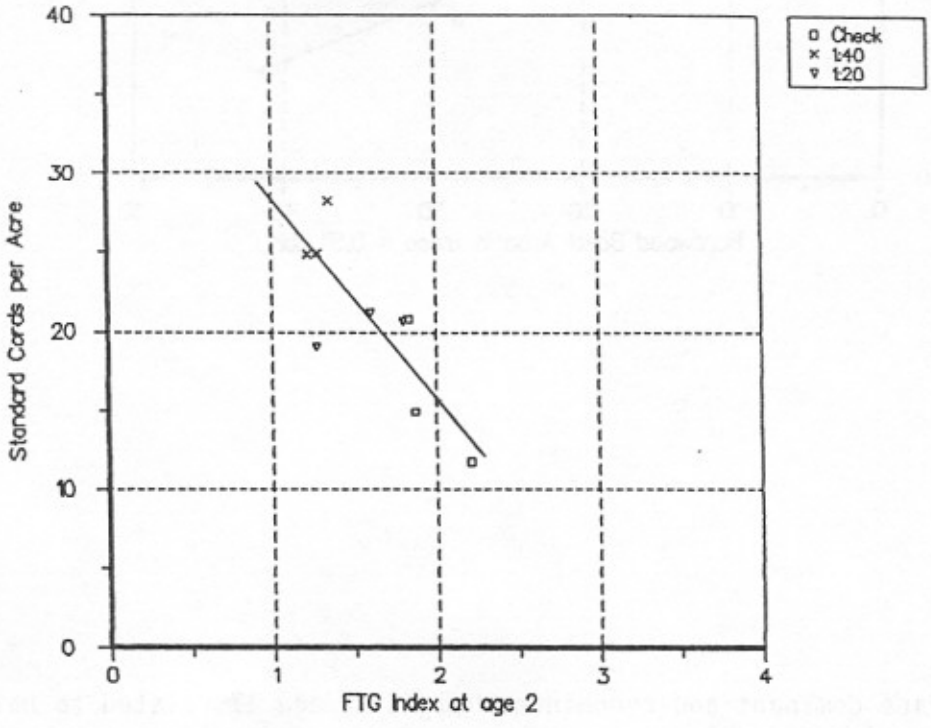

Figure 3. Pine cordwood yields at age 17 related to FTG index.

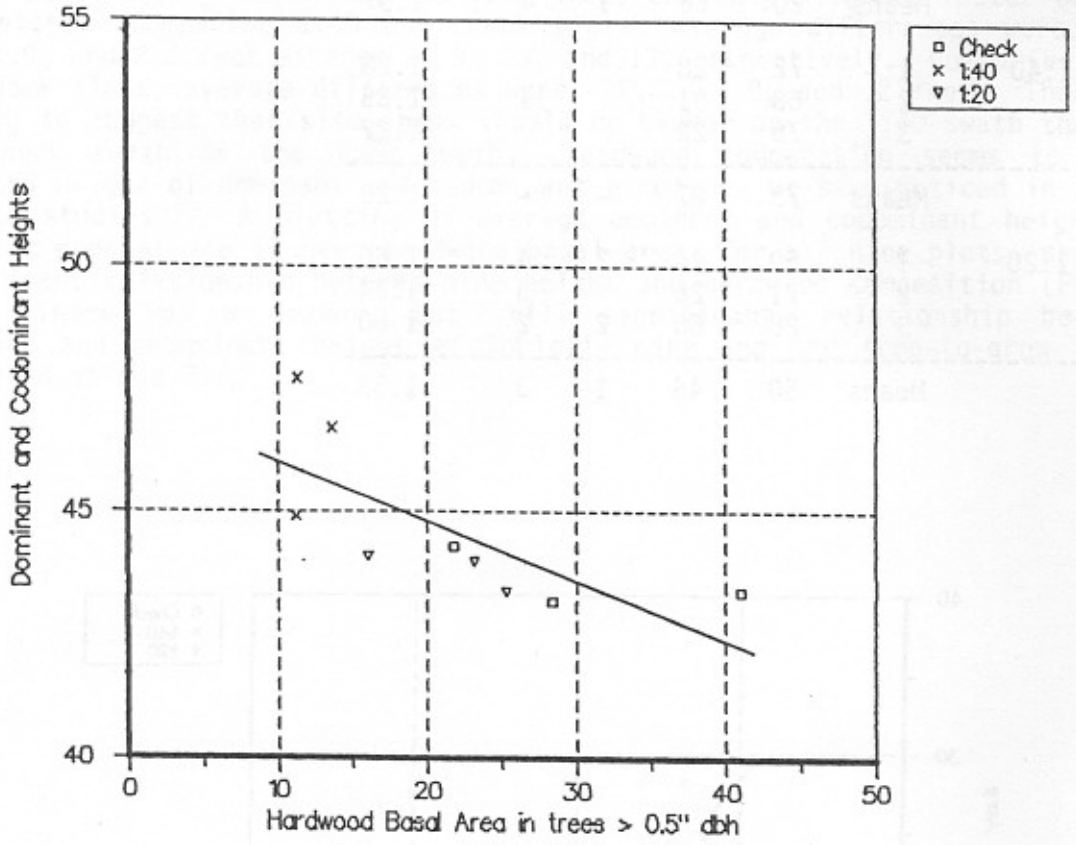

Figure 4. Pine dominant and codominant height at age 17 related to hardwood basal area.